

Mackenzie arrived at the same conclusion, but by a route I should not have followed. He selected the Clayton specimen as the type and said he would have done so even had that of Linnaeus been certainly the plant of the Upsala garden. To this, I should not have agreed; but since the plant of the Linnaean herbarium is not authentic, I must accept Mackenzie's conclusion if not his argument.

The nomenclature and synonymy of the two species concerned now become:

ACALYPHA RHOMBOIDEA Raf. New Fl. i. 45 (1836). *A. caroliniana* Walt. Fl. Car. 238 (1788)? (nomen dubium); certe sensu Michx. Fl. Bor.-Am. ii. 216 (1803). *A. crenulata* Raf. op. cit. 44 (1836), quoad synonyma citatum. *A. virginica* α *genuina* Muell. Arg. Linnaea, xxxiv. 44 (1845). *A. virginica* sensu Weatherby, RHODORA, xxix. 194 (1927), non L. (1753).

Var. **Deamii**, comb. nov. *A. virginica*, var. *Deamii* Weath. RHODORA, xxix. 197 (1927).

A. VIRGINICA L. Sp. Pl. 1003 (1753), excl. syn. Fl. Zeyl. *A. digyneia* Raf. Fl. Lud. 112 (1817); Weath. RHODORA, xxix. 198 (1927). *A. crenulata* Raf. New Fl. i. 44 (1836), quoad plantam descriptam? *A. brevipes*, var. *pubescens* Raf. l. c.? *A. virginica* β *intermedia* Muell. Arg. Linnaea, xxxiv. 45 (1865).

GRAY HERBARIUM.

PRESERVATION OF PLANT MATERIAL IN NATURAL COLORS

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WHILE the usual method of preparing herbarium specimens by drying and pressing the plant material has been satisfactory for preservation and identification, there is no doubt that the preservation of the natural color of the flowers and foliage would facilitate the identification of the specimens and differentiation of closely allied species. It is true that the newer method of rapid drying in controlled heat retains more of the natural color of the foliage and flowers, but the normal appearance of the floral parts is altered by the pressing.

Various solutions have been employed to preserve plant material, but most of them have had the disadvantage of decolorizing the foliage as well as the flowers. During the past three years I have tried out a number of solutions and formulae with some success, which is reported here.

As a rule only the flowers of the plants were selected for preservation, along with a typical leaf. If the flowers and leaves were large only a single flower and leaf were used, if small a typical portion of the inflorescence was used. Small cylindrical capsule vials one inch in diameter were used as containers. These have a wide mouth, closed by a bakelite screw cap. The height varied from two to four inches, the size used depending on the size of the plant specimen. The same containers have been used for all the experimental work except for a few very large specimens.

The solutions employed were alcohol, formaldehyde, sodium benzoate, hexylresorcinol solution, merthiolate, and several formulae selected from a list furnished through the courtesy of Mr. M. H. Haller of the United States Department of Agriculture. Haller collected a number of formulae from the literature, but states that his experience with them was limited, and that he had employed only one or two of them mainly in the preservation of fruits. Two of these formulae were finally found to give fair success with flowers, and will be designated as formula "A" and formula "B."

Alcohol has long been used as a preservative but did not prove at all suitable for plant material. The flowers and foliage were not only decolorized but became shrunken, due to the dehydrating action of the alcohol. Formaldehyde was used in various strengths, ranging from 1% to 5%, with good preservation of the material but leaving it completely decolorized or somewhat brownish. Sodium benzoate in 2% solution was tried. This solution has long been used to preserve the natural color of vegetables and fruits which have been cooked, but it did not preserve the color of the raw plant material, and had the disadvantage of making the specimen soft and flabby so that it sagged to the bottom of the vial. The same results were obtained with hexylresorcinol. Merthiolate, a mercurial, germicidal preparation was tried in dilutions ranging from 1-1000 to 1-20,000. The stronger solutions gave better preservation, but all dilutions caused a blotchy bluish-green discoloration of the flowers and tender leaves. However, the color preservation was better than with the solutions previously mentioned.

Formula "A" consisted of a single solution, made up as follows:

Sulphurous Acid.....	15 cc	Copper Sulphate.....	15 gm
Boric Acid.....	15 gm	Water to.....	1000 cc

Formula "B" was made up of two solutions. Solution one consisted of:

5% Solution Copper Sulphate

Solution two consisted of:

Commercial Sulphuric Acid.....	16 cc
Sodium Sulphite.....	21 gm
Water to.....	1000 cc

In using formula "B" the vials were filled with solution one and allowed to remain on the specimens twenty-four hours to set the colors. After washing several times in water the vials were then filled level full with solution two and sealed tightly. The vials were stored upright to prevent any possible leakage. From time to time the vials were checked and if the solution had become low more was added. Rarely some clouding occurred in the vials, particularly if the plant material was thick or if solid green fruits, such as those of the *Crataegus*, had been preserved. When this occurred the solution was changed and the specimen washed with water if necessary.

This formula has given good results in over 600 specimens collected during the past two years. The specimens appear as fresh as new material, the green color being clear and vivid, and the material firm and rigid. The normal shape was retained in most instances, except for the rolling of the petals in slender-rayed *Compositae* and in very fragile flowers such as those of *Portulacaceae* and *Commelinaceae*. Yellow flowers, especially of the *Compositae*, retained their color quite well but the more delicate shades of pink and blue, particularly in the fragile *Violaceae* and *Scrophulariaceae* faded out quickly and completely, often leaving the flowers transparent, showing the stamens and pistil through the corolla. Dark reds in both flowers and fruits faded out when preserved in this solution. This also occurred with dark blue fruits, the solution becoming so colored that it was difficult to see the specimens. It has not been quite as satisfactory for comparison between species, though the specimens are well preserved and can be removed from the vials and washed for inspection. It has proven better to use well developed fruits that are green than to use mature, highly colored fruits.

In checking over the specimens, the best results appear to have been obtained with grasses, sedges and rushes, which are entirely green. Good results were also obtained with the *Compositae*, *Labiatae*, *Polygonaceae* and *Cruciferae*. Except for the loss of color in the flowers

of the *Violaceae*, *Scrophulariaceae* and *Rosaceae*, the specimens are well preserved and have retained their normal shape.

Formula "A" also gave good results, but the solution was not as clear and the colors were not as well retained. However, it has the advantage of requiring no changing of solutions or handling of the specimens after they are once placed in the vials. Where it is not practical to change fluids, such as on field trips or where the facilities are not at hand, this method has been quite satisfactory. Vials filled with this solution can be carried on expeditions to preserve flowers and fruits that are likely to be crushed or altered in pressing and drying. Later these specimens can be removed for study along with the dried specimens and are of considerable aid in making determinations. For permanent preservation, however, formula "B" has given the best results.

The natural color of the preserved specimens makes easier identifications than the use of the dried, pressed specimens alone. Instead of a flat surface, as in the usual herbarium specimens, a three dimensional view is given. Comparing specimens to see if they are identical or not is made easier with this method, the small vials being more easily handled than the larger herbarium sheets. The natural green color of the foliage and the color of the flowers, where retained, give a more natural appearance to the specimens. Pubescence can readily be seen by holding the specimens in front of a light and viewing with a hand lens. Should it be necessary the specimens may be removed from the vials, washed with water, and studied. The firmness of the plant material is retained quite well.

This method of preserving plant material is not intended to take the place of the usual method for preparing herbarium specimens, but it is suggested as an additional aid in the identification and study of plant specimens. While the present formulae have given fair success, there is no doubt that further study will improve the solutions and add to their value.

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